

Investigating some heat-resistant ...

S/659/61/007/000/044/044
D231/D303

in eater then subjected to ageing at 700°C (for 10 hrs) had $\gamma + \sigma$ structure. In order to obtain maximum information on the effect of B at higher temperatures, the mechanical properties were investigated in the temperature range 20 - 700°C. Studied were: 1) Dependence of strength and ductility of steel with various additions of B on the temperature; 2) Impact strength (resilience); 3) Creep resistance; 4) Heat resistance at 700°C. The authors concluded that steels 1 and 2 of the austenite structure possess a much higher heat resistance than other steels (3, 4, 5, 6, 7) having two-phase ($\gamma + \sigma$) structure. Molybdenum increases the heat resistance of steels of both austenitic and two-phase structure. Alloying with Mo in amounts which do not cause formation of the second phase is useful. The optimum amount of Mo is that near to the saturation limit for a given concentration of N in the steel. Additions of B improve the heat resistance of steel. Of the alloys investigated those containing 0.001 % B showed the best effect. There are 3 figures and 10 references: 9 Soviet-bloc and 1 non-Soviet-bloc. The reference to the English-language publication reads as follows: J.T. Brown, Metal progr., 74, 2, 1958.

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X

ACCESSION NR: AT4013940

S/2659/63/010/000/0144/0148

AUTHOR: Prokoshkin, D. A.; Banny*kh, O. A.; Kovneristy*y, Yu. K.; Zudin, I. F.

TITLE: Chromium-manganese-aluminum austenite steel

SOURCE: AN SSSR. Institut metallurgii. Issledovaniya po zharoprochny*m splavam, v. 10, 1963, 144-148

TOPIC TAGS: steel, austenite steel, chromium-manganese-aluminum steel, austenite steel magnetic property, steel strength carbon content dependence

ABSTRACT: Austenitic steels with an Fe-Cr-Mn base are finding an ever-widening range of industrial application. The authors point out that the alloying of chromium-manganese steel with carbon and aluminum yields a satisfactory complex of strength properties at both normal and high temperatures. This paper gives the results of a study of the mechanical properties, as well as certain other properties, of chromium-manganese-aluminum steel. The study was based on an alloy of 9-10% Cr and 13-15% Mn, with a varying content of aluminum and carbon. Strength tests were made on IM-4P machines (tensile strength tests) and IP-5 machines (tests for creep and fatigue strength). The data obtained on short-term mechanical properties indicate that carbon definitely strengthens chromium-manganese-aluminum steel. An increase in plasticity results from increasing the amount of the plas-

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tic structural component (austenite) in the steel. The maximum is attained with a carbon concentration which provides for a 100% austenitic condition. An increase in the carbon content from 0.5 to 0.9% has no effect on the notch toughness of the steel, after annealing at temperatures of 1050-1150C. At temperatures of 700-750C, steel containing approximately 3% Al has reduced creep resistance when the carbon content is increased over the amount necessary for the creation of a stable austenitic structure. In the initial condition (after annealing), all the steels were non-magnetic. The long-term effect of temperature and stress led to the formation of up to 34-36% ferromagnetic phase in steel with 10% Cr, 14% Mn, and 0.1%C. When the aluminum concentration was increased from 3 to 6%, the authors noted a considerable rise in the ultimate strength value. This rise results from a certain strengthening of the austenite and from a considerable reduction of the grain that occurs with the appearance of small quantities of ferrite phase. In the fatigue-strength test, failure time was shortened drastically as the aluminum concentration was increased. A sample of austenitic steel with 3% Al did not fracture after 6000 hours of testing, and the total deformation was less than 1.1%. In the case of steel with 4.5% Al, the austenite partially decays under the influence of high temperature deformation. Although this steel was non-magnetic prior to the test, it was found to be about 35% magnetic after a failure time of 134 hours. The authors conclude that it is possible to obtain a metal with satisfactory heat resistance by the aluminum-alloying of Fe-Cr-Mn-C austenitic steel. However, the aluminum con-

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ACCESSION NR: AT4013940

tent must not exceed that which causes the appearance in the structure of a fer-
rite component, either in the initial (tempered) state, or after an extended ex-
posure to high temperatures and stress. It was also noted that an addition of
6-8% aluminum reduces the density of Cr-Mn steel by about 10-12%. Orig.
art. has: 5 figures and 4 tables.

ASSOCIATION: INSTITUT METALLURGI AN SSSR (Institute of Metallurgy, AN SSSR)

SUBMITTED: 00

DATE ACQ: 27Feb64

ENCL: 00

SUB CODE: ML

NO REF SOV: 004

OTHER: 001

Cord.

3/3

PROKOSHKIN, D.A.; MOLDAVSKIY, O.D.; BANNYKH, O.A.; KOVNERISTYY, Yu.K.

Effect of phosphorus and aluminum on the mechanical
properties of austenitic chromium-manganese steel. Izv. vys.
ucheb. zav.; chern. met. 6 no.12:147-151 '63.
(MIRA 17:1)

37730

S/180/62/000/002/009/018
E040/E135

121235
AUTHORS:

Ivanov, L.I., Matveyeva, M.P., Morozov, V.A., and
Prokoshkin, D.A. (Moscow)

TITLE:

On the self-diffusion of chromium

PERIODICAL:

Akademiya nauk SSSR. Izvestiya. Otdeleniye
tekhnicheskikh nauk. Metallurgiya i toplivo,
no.2, 1962, 104-106

TEXT:

In spite of the fact that chromium is widely used as an alloying element and that it serves as a basis of development of heat resistant alloys, its physico-chemical properties have not yet been fully investigated. Furthermore, such data as have been reported in technical literature are often very contradictory. For these reasons a re-examination was made of self-diffusion of chromium on specimens prepared from electrolytic chromium (99.96% pure) with nitrogen content of less than 0.010% and oxygen content of the order of 0.1%. The specimens were prepared by levitation melting and casting in copper moulds in an atmosphere of dry and purified helium. The specimens were in

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On the self-diffusion of chromium

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EO40/E135

the form of rings 16 mm in diameter. After polishing, Cr⁵¹ was deposited on the specimen surface under a vacuum of 10⁻⁵ mm Hg. Care was taken to ensure an even thickness of the deposit of the radioactive chromium. Diffusion annealing was carried out at 1050-1400 °C in a special vacuum furnace in a corundum crucible, using simultaneously two specimens positioned face-to-face; the actual annealing temperature being controlled by means of two Pt/Pt-Rh thermocouples. The self-diffusion coefficient of chromium was determined by a method described previously by I.B. Borovskiy, Yu.G. Miller and A.P. Shcherbakov (Ref.8: Samodiffuziya v α -Fe. Issledovaniya po zharoprochnym splavam (Self-diffusion in α -Fe. Research in Heat Resistant Alloys). Izd-vo AN SSSR, 2, 1957, 208) and by L.I. Ivanov and N.P. Ivanichev (Ref.9: Izv. AN SSSR, OTN, no.8, 1958). A layer with a thickness of about 10 microns was removed at each stage, the thickness of the layer thus removed being controlled with an accuracy of ± 0.001 mm. The radioactivity determination was on filter paper moistened with a 15% NaCl solution using scintillation counters and reference standards. The test results

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On the self-diffusion of chromium
 are plotted as $\log I$ vs. x^2 curves (I = intensity of radiation
 and x = distance from the specimen surface). Coefficients of
 volume diffusion of chromium were calculated from the above curve
 and are reported for various temperatures. The temperature
 dependence of chromium self-diffusion was found to obey the
 following relation: $D = 0.0647 \exp\left(\frac{-59200}{RT}\right)$ (1)

where R - universal gas constant and T - temperature.
 Investigation of the self-diffusion of chromium is also of great
 interest because chromium has a body-centred crystal lattice
 structure. If it is assumed that the vacancy mechanism of self-
 diffusion holds true for body-centred crystal lattice metals, it
 can be shown that $D_0 = a^2 v \exp\left(\frac{\Delta S}{R}\right)$ (3)

where: D_0 - self-diffusion velocity; a - lattice constant;
 v - atom oscillation frequency; ΔS - entropy of self-diffusion
 activation; R - gas constant. The entropy calculated in the
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On the self-diffusion of chromium

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E040/E135

present investigation was positive although negative entropies of chromium self-diffusion activation were previously reported by other workers. However, it was also shown previously that ΔS cannot be negative for metals with cubic crystal lattice structure if the energy of activation of self-diffusion exceeds 10 kcal/g.atom and if the vacancy mechanism of self-diffusion is assumed to apply.

There are 3 figures and 2 tables.

SUBMITTED: July 17, 1961

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LAZAREVA, I.Yu. (Moskva); PROKOSHKIN, D.A. (Moskva); VASIL'YEVA, Ye.V.
(Moskva)

Investigating the oxidation of tungsten-niobium alloys. Izv.
AN SSSR. Met. no.6:161-167 N-D '65. (MIRA 19:1)

1. Submitted November 19, 1964.

ACC NR: AP6008268

SOURCE CODE: UR/0080/66/039/002/0323/0327

AUTHOR: Prokoshkin, D. A.; Vasil'yeva, Ye. V.; Lazarev, E. M.

ORG: Institute of Metallurgy im. A. A. Baykov (Institut metallurgii)

TITLE: The kinetics and activation energy of oxidation of alloys of the Nb-V-Ti system

SOURCE: Zhurnal prikladnoy khimii, v. 39, no. 2, 1966, 323-327

TOPIC TAGS: ternary alloy, niobium alloy, vanadium containing alloy, titanium containing alloy, alloy oxidation, oxidation oxidation kinetics, oxidation resistant alloy

ABSTRACT: Ternary niobium-vanadium-titanium alloys containing 1, 3, 5, 8, 10, and 15 wt% V at a constant titanium content of 1, 5, and 10 wt% were melted in an arc furnace in an argon atmosphere, homogenized at 1400C for 25 hr in a vacuum of $5 \cdot 10^{-4}$ mm Hg, and oxidized in air at 900, 1000, 1100, and 1200C. Metallographic examination of the alloys in the cast and annealed conditions showed a homogeneous, single-phase structure of a solid solution of titanium and vanadium in niobium. In alloys with a low content of the alloying elements, the oxidation kinetics followed a parabolic rate in the initial stage, and approached a linear rate with prolonged exposure. At higher vanadium contents (10 and 15%), the oxidation kinetics followed a linear rate. Alloys containing 10 and 15% V oxidized more rapidly at 1000C than at 1100 or 1200C, which can be explained by partial sintering of the scale at higher

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ACC NR: AP6008268

temperatures. At all test temperatures the most oxidation-resistant were alloys containing 5 wt% V; an Nb-5% V-10% Ti alloy was the best. At all test temperatures the oxidation rate of ternary Nb-V-Ti alloys gradually decreased with increasing vanadium content, reached a minimum at a vanadium content of 5%, and then increased again to a value higher than that for unalloyed niobium at a vanadium content of 10-15%. The temperature dependence of the oxidation rate of Nb-V-Ti alloys (k) was found to follow an exponential law expressed by the equation $k = A \exp(-\frac{B}{RT})$, where A varied from $2.5 \cdot 10^5$ to $6.92 \cdot 10^2$ and B , from 13,800 to 27,500. Orig. art. has: 4 figures and 3 tables. [MS]

SUB CODE: 11/ SUBM DATE: 15Apr64/ ORIG REF: 003/ OTH REF: 005/ ATD PRESS 422

Card 2/2 *dw*

L 46115-66 EWP(e)/EWT(m)/T/EWP(t)/ETI/EWP(k) IJP(c) JD/HW/JG
ACC NR: AP6031379 (N) SOURCE CODE: UR/0145/66/000/007/0116/0119

AUTHOR: Prokoshkin, D. A. (Doctor of technical sciences; Professor);
Sidunova, O. I. (Candidate of technical sciences; Docent)

ORG: Moscow Higher Technical School im. N. E. Bauman (MVTU)

TITLE: Ordered solid solution in the chromium-molybdenum system

SOURCE: IVUZ. Mashinostroyeniye, no. 7, 1966, 116-119

TOPIC TAGS: ~~chromium~~ molybdenum alloy, chromium coated ~~molybdenum~~, chromium
molybdenum solid solution, ~~solid solution ordering~~ metal coating

ABSTRACT: Specimens of cast and forged molybdenum were diffusion coated with chromium, packed in chromium powder, and held at 1350—1600C for 10—25 hr. The diffusion layer was found to consist of three zones: the external zone, with columnar grains oriented in the direction of diffusion flow; the (hardest) middle zone, with similar grains which could hardly be etched and had equal atomic contents of chromium and molybdenum; and the inner zone, with polyhedral grains. An analysis of each zone showed that the external zone is a solid solution with variable concentration of components and a body-centered cubic lattice, while the middle zone has a tetragonal lattice. X-ray structural analysis of annealed alloy powders revealed the presence of tetragonal lattice lines and other odd lines which disappear under the effect of deformation. The appearance of a tetragonal lattice in chromium-molybdenum alloys may

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UDC: 669.2.01

L 46115-66

ACC NR: AP6031379

be associated with ordering of the solid solution. The appearance of the lines of a tetragonal lattice in all the alloys studied could be caused by dendritic heterogeneity. Orig. art. has: 4 figures. [ND]

SUB CODE: 11/ SUBM DATE: 02Mar66/ ORIG REF: 002/ ATD PRESS: 5087

Card 2/2 *LC*

L 02983-67	EWT(m)/EWP(w)/T/EWP(t)/ETI/EWP(k)	IJP(c)	JD/HW
ACC NR: AP6032461	SOURCE CODE: UR/0129/66/000/009/0051/0054		
AUTHOR: <u>Prokoshkin, D. A.</u> ; <u>Vasil'yeva, A. G.</u> ; <u>Akimov, V. V.</u> ; <u>Shinkarevich, Yu. B.</u> 52 B			
ORG: none			
TITLE: Effect of <u>deformation</u> temperature in thermomechanical treatment on <u>mechanical</u> properties and nil-ductility transition temperature of alloyed structural steel			
SOURCE: Metallovedeniye i termicheskaya obrabotka metallov, no. 9, 1966, 51-54			
TOPIC TAGS: structural steel, ^{alloy} steel thermomechanical property, steel, cryogenic metal working, temperature thermomechanical treatment, metal heat treatment, steel, solid mechanical property/40Kh5NSMF steel			
ABSTRACT: Several series of specimens of 40Kh5NSMF (0.46% C, 5.2% Cr, 1.6% Ni, 1.5% Mo, 0.55% Mn, 1.32% Si, 0.2% V) steel were austenitized at 1050C and subjected to thermomechanical treatment (TMT), rolled at 550—1050C with 50% reduction, quenched and then tempered at 200—300C. The tensile strength and yield strength were found to increase and ductility to decrease with decreasing deformation temperature (see Fig. 1). The NDT temperature dropped with increasing deformation temperature from -20C for steel rolled at 550C to -50C for steel rolled at 800—1050C. The strengthening effect of thermomechanical treatment was not eliminated by repeated hardening. However, the higher the temperature of TMT, the more stable the effect. Repeated hardening with short 5-min austenitizing at 1050C lowered the tensile			
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L 02983-67

ACC NR: AP6032461

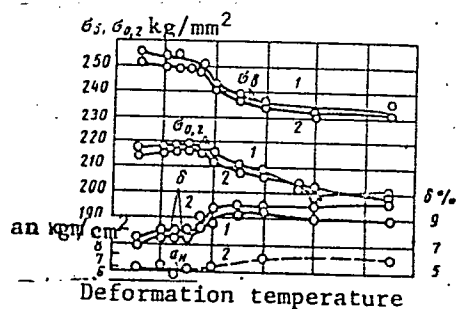


Fig. 1. Effect of deformation temperature on tensile strength (σ_b), yield strength ($\sigma_{0.2}$), elongation (δ), and notch toughness (α_n) of 40Kh5NSMF steel tempered at 200C (1) or 300C (2) after thermomechanical treatment.

strength of steel rolled at 550 and 1050C from 250 and 232 kg/mm² to 215 and 227 kg/mm², respectively. Orig. art. has: 3 figures and 2 tables.

SUB CODE: 11/ SUBM DATE: none/ ORIG REF: 005/ OTH REF: 001/ ATD PRESS: 5099

Card

2/2 *eqh*

L 00074-67 T EWT(m)/EWP(t)/ETI IJP(c) JD/JG/WB/GD

ACC NR: AP6034466

SOURCE CODE: UR/0000/66/000/000/0280/0285

AUTHOR: Lazareva, I. Yu.; Prokoshkin, D. A.; Vasil'yeva, Ye. V.; Maslenkov, S. B.

ORG: none

TITLE: Investigation of the oxidation resistance of tungsten-niobium-titanium alloys

SOURCE: AN SSSR. Institut metallurgii. Svoystva i primeneniye zharoprochnykh splavov (Properties and application of heat resistant alloys). Moscow, Izd-vo Nauka, 1966, 280-285

TOPIC TAGS: tungsten ~~niobium~~ alloy, ~~tungsten titanium alloy~~, tungsten niobium titanium alloy, ~~alloy~~ oxidation resistant, alloy oxidation ~~metal~~ alloy

ABSTRACT: The oxidation resistance of binary tungsten alloys with up to 50% niobium or titanium, and ternary tungsten-niobium-titanium alloys has been investigated. Niobium was found to be the most effective in increasing the oxidation resistance, especially at contents of up to 30%. Titanium at contents of up to 5% improves the oxidation resistance of binary alloys. At higher contents the titanium effect is negative, especially at temperatures above 1200C. Also in ternary alloys, the titanium effect is negative. Oxidation proceeds by a two-way diffusion of oxygen and metal with a preferred migration of niobium ions in the tungsten-niobium system and of titanium ions in the tungsten-titanium-niobium systems. Orig. art. has: 3 figures and 2 tables.

SUB CODE: 11/ SUBM DATE: 10Jun66/ ORIG REF: 004/ OTH REF: 001/ ATD PRESS: 5104

Card 1/1

L 08421-67 EWT(m)/EWP(k)/EWP(t)/ETI IJP(c) JD/JG/WB/GD
 ACC NR: AT6034465 (N) SOURCE CODE: UR/0000/66/000/000/0276/0280
 AUTHOR: Prokoshkin, D. A.; Arzamasov, B. N.; Ryabchenko, Ye. V.
 ORG: none
 TITLE: Investigation of molybdenum siliconizing in a glow discharge
 SOURCE: AN SSSR. Institut metallurgii. Svoystva i primeneniye zharoprochnykh splavov (Properties and application of heat resistant alloys). Moscow, Izd-vo Nauka, 1966, 276-280
 TOPIC TAGS: molybdenum, silicon, ~~glow discharge, heating, molybdenum-silicon coating, coating composition, oxidation, resistance~~ *metal coating, metal surface impregnation*
 ABSTRACT: The schematic and operation of a unit for siliconizing metals with glow-discharge heating are described. The experiments were made on pure molybdenum wire, 0.3 mm in diameter, in a mixture of silicon tetrachloride vapor and dry commercial-grade hydrogen. The design of the unit also permitted electric resistance heating of the wire. The partial pressure of silicon tetrachloride vapor and hydrogen was 30 and 10 mm Hg respectively. The temperature of siliconizing with glow-discharge heating was 1100C and with resistance heating--1300C. In both cases, heating the wire to the siliconizing temperature lasted 0.5 min, the holding

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L 08121-67
ACC NR: AT6034465

2

time at this temperature was 5 min, and the time of cooling to 200C was about 1 min. Regardless of the method of heating, no molybdenum siliconizing was observed in the absence of hydrogen in the ambient medium, but a silicide coating was readily formed on the wire surface when a mixture of silicon tetrachloride vapor and hydrogen was used. The weight and size of the test specimens also increased. The silicide coating consisted of an outer MoSi_2 phase, an inner Mo_3Si phase, and a thin layer, probably of the Mo_5Si_3 phase, between them. In siliconizing with glow-discharge heating, the silicon impregnation proceeded much more rapidly than with other methods, particularly at lower temperatures. Thus, siliconizing at 800C with glow-discharge heating and at 1200C with resistance heating produced silicide coatings of the same thickness. Regardless of the method of heating, the reaction products were the same as was also the oxidation resistance of the formed coatings, continuously or cyclically heated in air at 1500C. The maximum number of heating cycles sustained by coatings 40- μ thick was 330. Tungsten, niobium, tantalum and a number of other metals were also successfully siliconized with glow-discharge heating. Orig. art. has: 3 figures.

SUB CODE: 11/ SUBM DATE: 10Jun66/ OTH REF: 002/ ATDPPRESS: 5103
13/

Card 2/2 1s

L 08/20-67 EWT(m)/EWP(t)/ETI IJP(e) JD/WW/JG/WB/GD
ACC NR: AT6034467 (A) SOURCE CODE: UR/0000/66/000/000/0285/0290

AUTHOR: Prokoshkin, D. A.; Vasil'yeva, Ye. V.; Lazarev, E. M. 39
D+1

ORG: none

TITLE: Investigation of oxidation of niobium alloyed with vanadium,
titanium or zirconium 27

SOURCE: AN SSSR. Institut metallurgii. Svoystva i primeneniye
zharoprochnykh splavov (Properties and application of heat-resistant
alloys). Moscow, Izd-vo, Nauka, 1966, 285-290

TOPIC TAGS: niobium alloy, ~~niobium alloy~~ oxidation, vanadium containing
alloy, titanium containing alloy, zirconium containing alloy

ABSTRACT: Specimens of three series of niobium-base alloys, containing
1—15% vanadium and 1—10% titanium or 1—20% zirconium, arc melted in
an argon atmosphere, were subjected to oxidation tests in air at
900—1200C. It was found that the oxidation rate depends on the com-
position. The oxidation rate of the Nb-V-Ti alloys with 10% titanium
depends primarily on the vanadium content. It gradually decreases with
increasing vanadium content and at 1200C reaches a minimum of
6.3 mg/cm².hr at 5% of vanadium; then it increases and at 10% vanadium
is 20.9 mg/cm².hr, i.e., even higher than that of unalloyed niobium.

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ACC NR: AT6034467

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The alloy containing 5% V and 10% Ti had the highest oxidation resistance. It was established that 5% vanadium reduces the oxidation rate by 2—3 times, and 10% of titanium reduces it by 3—6 times. Only zirconium, of the three contents tested, was found to increase the oxidation rate. Orig. art. has: 3 figures.

SUB CODE: 11/ SUBM DATE: 10Jun66/ ORIG REF: 005/ OTH REF: 006/
ATD PRESS: 5103

Card 2/2 1s

L. 1000-67 Rm(m)/Bm(t)/MTI Tdp(c) JH/JH/WW
ACC NR: AP6035959 (A) SOURCE CODE: UR/0129/66/000/010/0067/0069

AUTHOR: Prokoshkin, D. A.; Arzamasov, V. N.; Fedoseyeva, S. N.

ORG: MVTU im. Bauman

TITLE: Calorizing of nickel by the circulation method

SOURCE: Metallovedeniye i termicheskaya obrabotka metallov, no. 10, 1966, 67-69

TOPIC TAGS: nickel, nickel calorizing, ^{metal}diffusion ~~layer composition, oxidation resistance~~, oxidation resistance *inhibition*

ABSTRACT: Specimens of electrolytic nickel were calorized in a gaseous medium continuously circulating in a closed two-reaction chamber apparatus at a pressure slightly higher than atmospheric. The gaseous medium was obtained from 99.996%-pure aluminum and dry hydrogen chloride or with pure aluminum chloride. The process was tested at 900, 950, and 1000C for 1-5 hr. It was found that the aluminum deposition rate in vapors from Al and AlCl₃ mixture was higher than that in vapors from Al and HCl, probably because of an increased content of chlorides in the medium owing to the absence of hydrogen. The weight gain increased with increasing exposure time and with increasing temperature of nickel specimens, and reached a maximum at 950C. With further temperature increase to 1000C, the weight gain decreased because of a decreased aluminum transfer to the nickel surface associated with a higher stability of aluminum chlorides. The diffusion layer formed in 1 or 5 hr deposition at 900C

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UDC: 669.24:621.785.34.53

L 10000-67

ACC NR: AP6035959

was 50 or 100 μ thick, respectively, and consisted of the α -solid solution of aluminum in nickel with a respective lattice parameter of 3.526 and 3.546 Å. The diffusion layer formed in 3 hr at 950C deposition temperature and 1000C evaporation temperature was 195 μ thick and consisted of the β -phase (NiAl), Ni₃Al and the α -solid solution of aluminum in nickel. Oxidation tests for 25 hr in air at 1000, 1100 and 1200C showed that the oxidation rate of the diffusion layer is much (65—70% at 1200C) lower than that of uncoated nickel. Orig. art. has: 5 figures.

SUB CODE: 11/ SUBM DATE: none/ ORIG REF: 001/ ATD PRESS: 5105

Card 2/2

ACC NR: AT603446

(A)

SOURCE CODE: UR/0000/66/000/000/0124/0127

AUTHOR: Prokoshkin, D. A.; Vasil'yeva, Ye. V.; Chudarev, L. F.

ORG: none

TITLE: Investigation of creep in niobium alloys by the torsion method

SOURCE: AN SSSR. Institut metallurgii. Svoystva i primeneniye zharoprochnykh splavov (Properties and application of heat resistant alloys). Moscow, Izd-vo Nauka, 1966, 124-127

TOPIC TAGS: niobium base alloy, creep, titanium containing alloy, boron containing alloy, molybdenum containing alloy, torsion stress

ABSTRACT: The investigation was made on samples of niobium with 5, 8, and 10 weight percent molybdenum, alloyed with titanium (up to 10%), boron (up to 2%), and zirconium (up to 10%). A figure shows the dependence of the deformation on time for different temperatures, obtained by conventional and temperature cycle methods for a niobium alloy with 5% molybdenum and 0.5% boron. The closeness of the values of the creep rate at the same temperature, by the two methods, indicates that the temperature cycle method can be used even in the case of complex alloys. To obtain comparative values of the creep rate, the temperature interval of the experiments was varied somewhat as a function of the composition of the alloy. In particular, alloys containing 10%

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ACC NR: AT603446

titanium and 10% zirconium were tested at lower temperatures. A second figure shows a semilogarithmic plot of the dependence of the deformation on temperature for a large number of different alloys. The values of the effective activation energy for creep can be determined from the slope of the straight on the plot. On the basis of the experimental results the conclusion is drawn that it is not possible to establish a correlation between the activation energy for the creep and the activation energy for autodiffusion. Orig. art. has: 3 figures.

SUB CODE: 11/ SUBM DATE: 10Jun66/ ORIG REF: 006/ OTH REF: 005

Card 2/2

ACC NR: AP7006204

SOURCE CODE: UR/0363/67/003/001/0087/0093

AUTHOR: Prokoshkin, D. A.; Zakharova, M. I.

ORG: Metallurgy Institute im. A. A. Baykov, Academy of Sciences, SSSR (Institut metallurgii Akademii nauk SSSR)

TITLE: Isothermal sections at 600 and 750°C of the molybdenum-titanium-zirconium phase diagram

SOURCE: AN SSSR. Izvestiya. Neorganicheskiye materialy, v. 3, no. 1, 1967, 87-93

TOPIC TAGS: molybdenum alloy, zirconium alloy, titanium alloy, alloy phase diagram

ABSTRACT: On the basis of x-ray and microstructural analyses and measurements of the hardness of alloys after quenching from the equilibrium state at 750 and 600°C, isothermal sections at these two temperatures of the phase diagram of the Mo-Ti-Zr system were constructed. A sizable region of a β solid solution, extending continuously from the Mo-Ti system to the Ti-Zr system and bounded by a region of heterogeneous state of the alloys on the side of the Mo-Zr system, was found in the section at 600°C (see Fig. 1). The region of heterogeneous state of the alloys occupies a small part of the concentration triangle and protrudes toward the titanium corner (see Fig. 1). Unmixing of the β solid solution into two solid solutions occurs at an equiatomic content of Mo in Zr and 61 at. % Ti. Two three-phase regions, $\beta_1 + \beta_2 + \delta$ and $\alpha + \beta_2 + \delta$, exist inside the heterogeneous region. The δ phase extends up to 13 at. % Ti

Card 1/3

UDC: 546-3-19-77-821-831

ACC NR: AP7006204

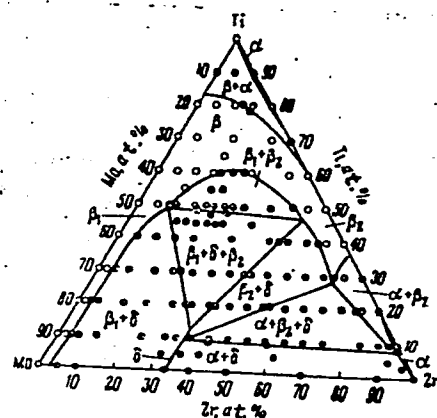


Fig. 1. Isothermal section at 600°C of the phase diagram of the Mo-Ti-Zr system. • - boundary of phase regions based on x-ray diffraction data

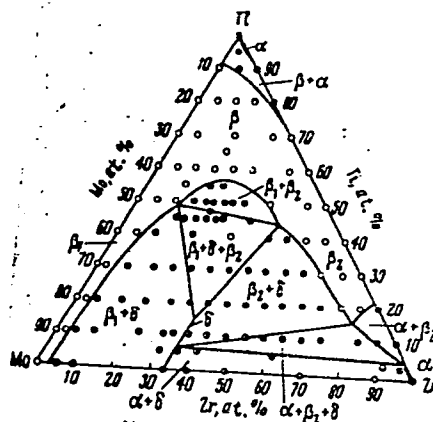


Fig. 2. Isothermal section at 750°C of the phase diagram of the Mo-Ti-Zr system

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ACC NR: AP7006204

at 33.3 at. % Zr in the ternary system; no appreciable solubility has been noted in this phase. The isothermal section at 750°C (see Fig. 2) is basically no different from the section at 600°C, but the region of the β solid solution increases considerably both at the expense of the heterogeneous region (on the side of the Mo-Zr system) and at the expense of the two-phase $\alpha + \beta$ regions adjacent to the Ti and Zr corners of the section. Unmixing of the β solid solution takes place at 57 at. % Ti and 19 at. % Zr. At 750°C, the region of the δ phase degenerates into a line (as it does at 600°C) and exists in this section up to 15 at. % at 33.3 at. % Zr. Orig. art. has: 9 figures.

SUB CODE: 007/ SUBM DATE: 09Feb66/ ORIG REF: 004/ OTH REF: 008

Card 3/3

ACC NR: AP7002431

(A)

SOURCE CODE: UR/0219/66/000/012/0021/0024

AUTHOR: Vasil'yeva, Ye. V.; Prokoshkin, D. A.; Belova, L. M.

ORG: Institute of Metallurgy AN SSSR (Institut metallurgii AN SSSR)

TITLE: The structure and properties of niobium-tantalum alloys containing tungsten and molybdenum

SOURCE: Metallovedeniye i termicheskaya obrabotka metallov, no. 12, 1966, 21-24 and inserts facing pages 48 and 49

TOPIC TAGS: niobium, tantalum alloy, molybdenum containing alloy, tungsten containing alloy, alloy structure, ~~alloy~~ property metal

ABSTRACT:

The effect of tantalum (0.5, 1, 5, 10 or 15%), molybdenum and tungsten (5% of each) on the microstructure and room and high-temperature hardness of niobium-base alloys has been investigated. The alloys were melted from 99.4%-pure niobium, 99.75%-pure tantalum, 99.65%-pure molybdenum and 99.95%-pure tungsten in a nonconsumable (tungsten) electrode, vacuum-arc furnace in an argon atmosphere. Alloy ingots were annealed at 1700C for 50 hr. It was found that the microstructure of cast Nb-Ta alloy had the typical structure of a single-phase solid solution. With increasing tantalum content, the substructure became more distinct. As-cast Nb + 5% Ta + 5% Mo and Nb + 10% Ta + 5% Mo alloys also had a single-phase structure with

UDC: 620.17:669.293'294'27'28

Card 1/2

ACC NR: AP7002431

elongated grains and traces of dendritic segregation. A noticeable segregation of impurities was observed in Nb + 5% Ta + 5% W and Nb + 10% Ta + 5% W alloys. The respective hardness at 20 and 1000C of Nb + 10% Ta alloy was 180 and 105 HV. Additional alloying with 5% molybdenum or 5% tungsten increased the hardness to 198 and 127 HV or to 192 and 120 HV, compared to 150 and 90 HV for unalloyed niobium. The creep rate (calculated from the results of hot hardness tests) of alloys containing molybdenum and tantalum was the

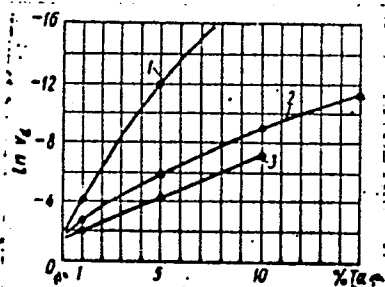


Fig. 1. Composition dependence of creep rate (V_d) of Nb-Ta, Nb-Ta-Mo and Nb-Ta-W alloys at 1000C

lowest and that of alloys containing tantalum and tungsten the highest (see Fig. 1). . Orig. art. has: 4 figures and 2 tables.

SUB CODE: 11/ SUBM DATE: none/ ORIG REF: 008/ OTH REF: 003/ ATD PRESS: 5113

Card 2/2

L 43099-66 EWT(m)/EWP(t)/ETI IJP(c) JD/HW/JG/WE
 ACC NR: AP6014122 (A) SOURCE CODE: UR/0370/65/000/006/0161/0167

AUTHORS: Lazareva, I. Yu. (Moscow); Prokoshkin, D. A. (Moscow); Vasil'yeva, Ye. V. (Moscow)

ORG: none

TITLE: Investigation of the oxidation of tungsten-niobium alloys

SOURCE: AN SSSR. Izvestiya. Metally, no. 6, 1965, 161-167

TOPIC TAGS: oxidation, tungsten containing alloy, niobium containing alloy, x ray spectroscopy, oxidation kinetics

ABSTRACT: The effect of alloying tungsten with niobium on the oxidation properties of tungsten was investigated. The investigation supplements the results of D. A. Prokoshkin, Ye. V. Vasil'yeva, and I. Yu. Lazareva (Kinetika okisleniya splavov vol'frama s niobiyem. Sb. Issledovaniya metallov v zhidkom i tverdom sostoyaniakh. K 80-letiyu so dnya rozhdeniya akad. I. P. Bardina, Izd-vo. Nauka, 1964, 241). The oxidation kinetics and x-ray spectra of the formed oxides of tungsten-niobium alloys containing 1--50 wt % Nb were studied at 900, 1000, 1100, 1200, and 1300C. The experimental results are summarized in graphs and tables (see Fig. 1). The alloy containing 30 wt % Nb had the greatest resistance toward oxidation. It is concluded that the beneficial effect of the addition of Nb to W results from the formation of phases which exhibit stronger interatomic bonds and from the character of the oxide scale and subscale.

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UDC: 669.27

L 43099-66

ACC NR: AP6014122

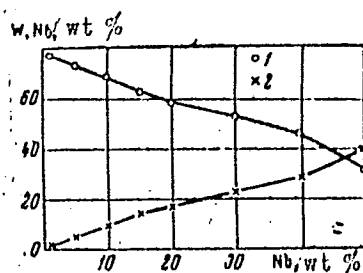


Fig. 1. Change in the tungsten (1) and niobium (2) content in the oxide scale at an oxidation temperature of 1200C as a function of the niobium content in the alloy.

Orig. art. has: 2 tables and 5 figures.

SUB CODE: 11/ SUBM DATE: 19Nov64/ ORIG REF: 008/ OTH REF: 003

Card 2/2 MLP

L 33357-66 EWP(e)/EWT(m)/EWP(w)/T/EWP(t)/ETI IJP(c) JD/WW/JG

ACC NR: AP6019643

SOURCE CODE: UR/0149/66/000/003/0118/0122

AUTHOR: Prokoshkin, D. A.; Vasil'yeva, Ye. V.; Chudarev, L. F.

ORG: Higher Technical School im. N. E. Bauman (Vyssheye tekhnicheskoye uchilishche)

TITLE: Investigation of some properties of niobium alloys

SOURCE: IVUZ. Tsvetnaya metallurgiya, no. 3, 1966, 118-122, and insert facing p. 122

TOPIC TAGS: niobium, niobium alloy, molybdenum containing alloy, titanium containing alloy, boron containing alloy, zirconium containing alloy, alloy property

ABSTRACT: The microstructure, room- and high-temperature hardness, oxidation and creep resistance, specific weight and electric resistance have been investigated in Nb + 5% Mo alloys additionally alloyed with 10% Ti, 2% B and 2% Zr. The alloys were melted from 99.78%-pure Nb, 99.95%-pure Mo, 99%-pure B and 99.9%-pure Ti and Zr in a nonconsumable electrode arc vacuum furnace, and homogenized in a vacuum of 10^{-4} mm Hg for 25 hr: alloys with Ti at 1400C and other alloys at 1600C. Cast and annealed Nb-Mo and Nb-Mo-Ti alloys had a single-phase microstructure without noticeable dendrite liquation. Alloying with boron brought about a clearly defined dendrite structure which remained after the addition of zirconium. Annealed alloys with boron contained segregations of a boride phase with a eutectic. Alloys with zirconium contained dispersed phases with a very complex composition. As the composition of the alloys

Card 1/3

UDC: 669.293.018

L 33357-66

ACC NR: AP6019643

became more complex with each successive alloying, the specific weight of the alloys decreased continuously from 8.67 g/cm^3 in the initial Nb+5% Mo alloy to 7.75 g/cm^3 in Nb+5% Mo+10% Ti+2% B+2% Zr alloy. Simultaneously, the electric resistivity increased continuously from 18.8 to $44.0 \text{ } \mu\text{ohm}\cdot\text{cm}$, which is explained by the lattice distortion and increasing scattering of electrons. A similar continuous increase was observed in the hardness of the alloys, which increased from 156 HB in Nb+5% Mo alloy to 376 HB in the most complex Nb+5% Mo+10% Ti+2% B+2% Zr alloy, compared with 115 HB in annealed pure Nb. Hot hardness was measured in the 600–1100C range (see Fig. 1).

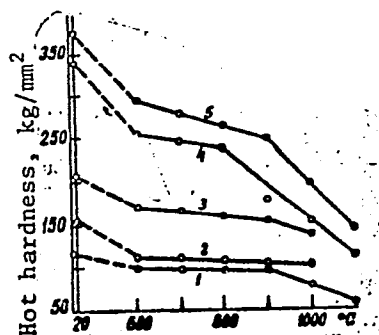


Fig. 1. Temperature dependence of the hardness of niobium and niobium alloys

1 - Nb; 2 - Nb+5% Mo; 3 - Nb+5% Mo+10% Ti;
4 - Nb+5% Mo+10% Ti+2% B; 5 - Nb+5% Mo+10% Ti+2% B+2% Zr.

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L 33357-66

ACC NR: AP6019643

The rate of creep calculated from the data on hot hardness showed that boron-containing alloys had a low rate of creep, although their hot hardness increased significantly with increasing temperature. This is explained by the strengthening of the solid solution with molybdenum and by the formation of fine dispersed boride precipitates which block the shear planes. The oxidation resistance of niobium is most effectively increased by alloying with Mo and Ti, which forms $(Nb, Mo, Ti)_2O_5$ solid solution and a $5Nb_2O_5 \cdot 2TiO_2$ compound with monoclinic structures in the scale. Because diffusion of oxygen through the lattice of these phases is much slower than through the lattice of $B-Nb_2O_5$ scale on unalloyed niobium, the oxidation rate of the alloys with Mo and Ti is significantly lowered. Alloying with B and Zr in the amounts investigated (2% each) had no substantial effect on the oxidation resistance of the alloys. Orig. art. has: 1 figure and 2 tables. [MS]

SUB CODE: 11/ SUBM DATE: 18Jan65/ ORIG REF: 007/ OTH REF: 001/ ATD PRESS: 5026

Card 3/3 B16

PROKOSHKIN, D.A.; VASIL'YEVA, A.G.; AKIMOV, V.V.

Strength and plasticity of alloyed steels following a low-
temperature thermomechanical treatment. Metalloved. 1 term.
obr. met. no.11:31-33 N '65. (MIRA 18:12)

1. Moskovskoye vyssheye tekhnicheskoye uchilishche im. Baumana.

L 2661-66 ENT(m)/EWP(w)/EPF(c)/T/EWP(t)/EWP(b)/EWA(c) IJP(c) JD/JG/WB/GS

ACCESSION NR: AT5023090

UR/0000/65/000/000/0111/0117

AUTHOR: Vasil'yeva, Ye. V.; Prokoshkin, D. A.; Chuang, Hsiang-ling

TITLE: Microstructure and oxidation resistance of the alloys of niobium with tungsten, aluminum and titanium

SOURCE: Problemy bol'shoy metallurgii i fizicheskoy khimii novykh splavov (Problems of large-scale metallurgy and physical chemistry of new alloys); k 100-letiyu so dnya rozhdeniya akademika M. A. Pavlova. Moscow, Izd-vo Nauka, 1965, 111-117

TOPIC TAGS: high temperature oxidation, niobium base alloy, grain structure, solid solution, titanium containing alloy, crystal defect

ABSTRACT: Tungsten is an element that toughens niobium. In most cases, however, Nb-W alloys display insufficient resistance to oxidation; this can be remedied by alloying with Al and Ti. What is more, Ti also improves the plasticity and ease of treatment of Nb, which cannot be said of Al, since if the Al content exceeds 5-10% this leads to embrittlement of the base. In this connection, the authors investigated alloys of Nb with 5, 10, and 15 wt.% W and an Al content

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L 2661-66

ACCESSION NR: AT5023090

of from 1 to 3.5%, with the object of determining the effect of W and Ti on the oxidation resistance of the binary Nb-W alloys at 1000, 1100, and 1200°C. The alloys were prepared from pure metals (in a tungsten-electrode arc furnace with an argon atmosphere, and annealed (homogenized) at 1400-1600°C for 50-200 hr. The microstructure of the alloy ingots was dendritic, with uniform grain size. Since part of the specimens was charged in polished form into the furnace, annealing resulted in thermal etching which revealed certain features of the microstructure. Individual grains displayed characteristic striation which on some acquired the form of spirals following the tracks of the branches of former dendrites. There is not yet a unified theory accounting for the nature of such effects; many factors are involved: the atmosphere in which the thermal etching takes place, and particularly its content of "active" agents -- O_2 , H_2 , H_2O (vapors), H_2S , etc., and their partial pressure. In addition, test temperature, the nature of the metal investigated, crystallography of the specimen, and other characteristics also are of major significance. In its ultimate appearance, following re-polishing and etching with a reagent consisting of H_2SO_4 , HNO_3 , and H_2F_2 , the microstructure of all the alloys represented a monophasic solid solution. Oxidation resistance of the alloys was determined according to weight gain per time unit by means of periodic weighing following exposures of 1, 2, 3, 5, and 10 hr

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ACCESSION NR: AT5023090

to temperatures of 1000, 1100, and 1200°C in a silit furnace with an air atmosphere. Findings: as W content is increased from 5 to 10 wt.%, the oxidation rate decreases (from 19.2 mg/cm²-hr to 10.5 mg/cm²-hr). In alloys with 15 wt.% W the pattern is somewhat different: at 1000°C the oxidation rate increases, while at 1100 and 1200°C it decreases. Alloying with 5 wt.% Ti produces a very marked decrease in oxidation rate. Thus, the oxidation rate of Ti-containing alloy at 1000°C is 5.6 mg/cm²-hr and at 1100°C, 6 mg/cm²-hr. The scale from specimens oxidized at 1200° was pulverized and subjected to a X-ray analysis. At oxidation temperature of 1200°C niobium oxide was thus found to consist of β -Nb₂O₅ with a monoclinic lattice and parameters: a = 20.39 Å; b = 3.82 Å; c = 19.44 Å; α = 115°89'. Roentgenograms of all the alloys clearly displayed β -Nb₂O₅ lines: there were no other lines. Apparently, the scale represents a solid solution on β -Nb₂O₅ base, containing oxides of the alloy elements. The ion radius of W is shorter than that of Nb (0.62 vs. 0.66 Å). Apparently, the dissolution of W in Nb₂O₅ results in a decrease in volume of the scale owing to substitution, i.e. the volume ratio of the oxide to the metal decreases; this results in a more compactly adhering oxide film with enhanced protective properties. Moreover, according to Wagner's theory, the addition of an alloy element with a higher valence than

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ACCESSION NR: AT5023090

that of the base should cause an increase in the number of free electrons and a decrease in the number of lattice defects. This leads to an increase in electron conduction and decrease in ion conduction, i.e. in diffusion rate. The valence of W (6+) exceeds the valence of Nb (5+). Accordingly, W is bound to augment the oxidation resistance of Nb. The presence of Ti causes the formation of the solid solution TiO_2 in the Nb_2O_5 of the scale. Apparently, the dissolution of Ti makes the scale's lattice less favorable to the diffusion of oxygen ions than the lattice $\beta-Nb_2O_5$. Orig. art. has: 3 figures, 3 tables.

ASSOCIATION: none

SUBMITTED: 00

ENCL: 00

SUB CODE: MM, SS

NO REF SOV: 007

OTHER: 005

Card 4/4

L 2660-66 EWT(m)/EPF(c)/T/EWP(t)/EWP(b)/EWA(c) IJP(c) JD/HW/JG/WB/GS

ACCESSION NR: AT5023091

UR/0000/65/000/000/0118/0124

AUTHOR: Prokoshkin, D. A.; Vasil'yeva, Ye. V.; Ryabyshev, A. M.

TITLE: Oxidation of the alloys of niobium with tungsten

SOURCE: Problemy bol'shoy metallurgii i fizicheskoy khimii novykh splavov
(Problems of large-scale metallurgy and physical chemistry of new alloys);
k 100-letiyu so dnya rozhdeniya akademika M. A. Pavlova. Moscow, Izd-vo Nauka,
1965, 118-124

TOPIC TAGS: niobium alloy, tungsten containing alloy, high temperature oxidation, oxidation kinetics, gas diffusion, metal scaling

ABSTRACT: Alloys of Nb with W are of major interest, since W markedly enhances the high-temperature strength of Nb. But while the data on the high-temperature strength of Nb-W alloys unambiguously point to the favorable effect of W, the data on another important characteristic -- the effect of W on the oxidation resistance of Nb -- are extremely contradictory. In an effort to clarify this point, the authors investigated the oxidation kinetics of Nb-W alloys containing 0.5 to 40 wt.% W, at temperatures of 1000, 1100, and 1200°C, by heating alloy

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L 2660-66

ACCESSION NR: AT5023091

specimens in the air for 1, 2, 5, and 10 hr, while at the same time continually weighing them. It was found that the time-dependence of the weight gain due to oxidation obeys a parabolic law in the initial stage (Fig. 2). During this stage the oxidation rate is determined by the rate of O_2 diffusion through the oxide film forming on the alloy's surface. The thickness of the oxide layer increases in accordance with the parabolic law until, owing to the great difference in the unit volumes of the metal and oxide, there arise considerable stresses which lead to the cracking of the oxide and its peeling from the metal, whereupon the time-dependence of weight gain begins to obey a linear law. Noteworthy is the anomalous course of the temperature dependence of the oxidation rate: thus, at $1000^\circ C$ this rate is higher than at $1100^\circ C$. At $1200^\circ C$ the oxidation rate increases somewhat and approaches the values obtained at $1000^\circ C$. X-ray analysis established that under these conditions the oxidation rate of the alloys is chiefly determined by the structure of the scale, and in particular by the formation of the solid solution $(Nb, W)_2O_5$. Thus, the reason for the decrease in the oxidation rate of the alloys is that the diffusion of oxygen across the scale's lattice leads to a decrease in the oxide-to-metal volume ratio, hence resulting in a decrease in the peeling of the oxide film off the metal. Hence, by the same token, the observed

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Card

L 2660-66

ACCESSION NR: AT5023091

character of the temperature dependence of oxidation rate cannot be attributed to the retardation of the diffusion of oxygen through the scale. Orig. art. has: 4 figures, 1 table.

ASSOCIATION: none

SUBMITTED: 00

ENCL: 01

SUB CODE: MM, 03

NO REF SOV: 005

OTHER: 009

Card 3/4

L 2660-66

ACCESSION NR: AT5023091

ENCLOSURE: 01

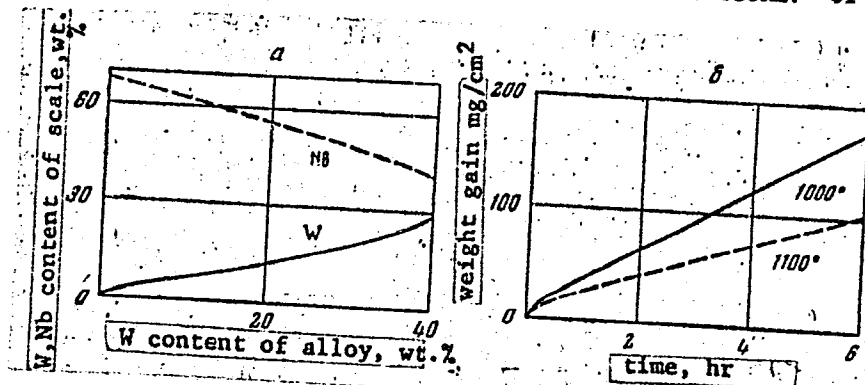


Fig. 2. Scale composition as a function of the W content of alloy (a) and of weight gain with time, Nb + 15% W at 1000-1100°C (b)

Card

L 2659-66 EWP(e)/EWT(m)/EWP(w)/EPF(c)/ENP(i)/T/EWP(t)/EWP(b)/EWA(c) IJP(c)
JD/JG/WB/GS

ACCESSION NR: AT5023092

UR/0000/65/000/000/0125/0129

AUTHOR: Vasil'yeva, Ye. V.; Prokoshkin, D. A.; Belova, L. M.

TITLE: Certain properties of the alloys of niobium with boron

SOURCE: Problemy bcl'shoy metallurgii i fizicheskoy khimii novykh splavov
(Problems of large-scale metallurgy and physical chemistry of new alloys);
k 100-letiyu so dnya rozhdeniya akademika M. A. Pavlova, Moscow, Izd-vo Nauka,
1965, 125-129

TOPIC TAGS: niobium base alloy, boron containing alloy, alloy phase diagram,
high temperature oxidation, X ray analysis

ABSTRACT: The properties of alloys based on the Nb-B system are virtually un-
known although the constitution diagram of the binary Nb-B system is known
(H. Novotny, F. Benezovsky, R. Kieffer, Zts. Metallkunde, 50, 7, 417, 1959);
this diagram provides no definite information on the solubility of B in Nb and
vice versa, since the solubility lines in both cases are plotted in broken-line
form. It is also known that the oxidation rate of Nb at 600 and 800°C decreases
as a result of alloying with B. But no other data on the properties of Nb-B alloys

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ACCESSION NR: AT5023092

are available. To fill this gap, the authors investigated the properties of the alloys of Nb with 0.01, 0.05, 0.1, 0.5, 1, 3, and 5 wt.% (increasing the B content above 5 wt.% leads to a marked embrittlement of the alloys). The microstructure of homogenized specimens of the alloys was examined with the aid of an etching agent consisting of 1 part HNO_3 + 1 part HF. It was found that the phases over the grain boundaries, visible in the ingot structure of the alloys containing upward of 1% B became completely dissolved during homogenization annealing, with a marked polygonization. At 3% B the microstructure is characterized by a finer grain compared with the alloy containing 0.1% B. Boron markedly reduces the density of the alloys, despite its relatively small content. Reason: the extremely low density of B (2.34 g/cm^3) and boride compared with the density of niobium (8.57 g/cm^3). Oxidation resistance was determined by periodic weighing following exposure to air at 1000, 1100, and 1200°C for up to 20 hr. The oxidation products were subjected to X-ray analysis. At a B content of up to 1% the oxidation rate of Nb rises considerably ($\sim 130 \text{ mg/cm}^2$), whereas any further increase in the B content of the alloys leads to a decrease in this rate. According to X-ray findings, the structure of the scale of Nb with 1% B is a high-temperature modification of $\beta\text{-Nb}_2\text{O}_5$; hence, the sharp increase in oxidation rate

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Card

L 2659-66

ACCESSION NR: AT5023092

cannot be attributed to any changes in the scale structure and apparently is due to its microstructural features, particularly the large amount of second phase. The decrease in oxidation rate when the B content is raised above 1% is to some extent associated with the change in the structure of the alloys. Alloying with even small quantities of B (0.01 and 0.05%) causes a sharp increase in the hardness of Nb at room temperature but produces no effect at 1000°C -- unless the boron content is raised to 2% and higher. The higher the B content is, the lower is the rate of creep of the alloy. Orig. art. has: 4 figures, 1 table.

ASSOCIATION: none

SUBMITTED: 00

ENCL: 00

SUB CODE: MM, 20

NO REF SOV: 002

OTHER: 002

Card 3/3

E 63285-65 EPF(c)/EPF(n)-2/ENP(z)/ENT(m)/ENP(h)/T/ENH(d)/ENP(w)/ENP(t) Pu-4
 ACCESSION NR: AP5016013 IJP(c) JD/JG/WB UR/0145/65/000/005/0164/0170
 546.882 35
 34
 3
 AUTHORS: Vasil'yeva, A. G. (Candidate of technical sciences, Docent);
 Prokoshkin, D. A. (Professor, Doctor of technical sciences)
 TITLE: Investigation of the properties of niobium spring alloys 18
 SOURCE: IVUZ. Mashinostroyeniye, no. 5, 1965, 164-170 27
 TOPIC TAGS: niobium alloy, titanium alloy, aluminum alloy, spring alloy, alloy
 property 27 27 6
 ABSTRACT: The elastic relaxation and corrosion resistive properties of Nb-Ti
 (alloy No. 1: 10.5% Ti, 0.04 Cu, 0.6 W, rest Nb) and Nb-Al (alloy No. 2: 2.1% Al,
 0.09 Cu, 0.6 W, the rest Nb) alloys were experimentally determined as a function

L 63285-65

ACCESSION NR: AP5016013

were measured as a function of annealing temperature (700-900C for Nb-Ti, 800-900C for Nb-Al) after it was found that the recrystallization temperatures were 1100C (10% deformation) and 950C (85% deformation) for Nb-Ti and 1000C (10%) for Nb-Al alloys. It was found that the elastic modulus for the Nb-Ti alloy was maximum after annealing (for 1/2 hour) at 850C for 10% deformation (10 700 kg/mm) and at 800C for 85% deformation (9700 kg/mm); for Nb-Al the maximum was 10 500 kg/mm

tance tests showed that no-22 was
4 figures and 3 tables.

ASSOCIATION: none

SUBMITTED: 04Apr64

NO REF SOV: 004

Card 2/2K

ENCL: 00

OTHER: 001

SUB CODE: MM

L 1052-66 EWT(m)/EWP(w)/EWA(d)/T/EWP(t)/EWP(k)/EWP(z)/EWP(b)/EWA(c) MJW/JD/HW

ACCESSION NR: AP5022355

UR/0133/65/000/009/0846/0848
669.18:658.562

AUTHOR: Supov, A. V.; Prokoshkin, D. A.; Rakhshadt, A. G.; Medvedev, V. A.

TITLE: Effect of cold working on the physical properties and fine structure of steel subjected to thermomechanical treatment

SOURCE: Stal', no. 9, 1965, 846-848

TOPIC TAGS: cold working, spring steel, metal hardening, plastic deformation, mechanical heat treatment/ 55KhRG, spring steel

ABSTRACT: The hardening that occurs in steels following their thermomechanical treatment (TMT) is usually associated with the rise of a special fine structure with AP-1000. Hence it may be expected that on additional treatment of the fine structure (e.g. by means of limited plastic deformation) the properties of steel previously subjected to TMT should also markedly change. In this connection, the authors investigated the effect of cold plastic deformation on the properties of spring steel 55KhRG (0.52% C, 0.9% Cr, 1.1% Mn, 0.005% B) following its high-temperature

Card 1/3

L 1052-66

ACCESSION NR: AP5022355

thermomechanical treatment (HTMT), on utilizing the hereditary hardening effect (the "reversibility" effect) which consists in that if a steel, following its HTMT, is tempered to a hardness allowing its machining with cutting tools, its reheating without deformation and tempering causes it to re-acquire the properties it had acquired directly following HTMT, i.e. the effect of the original work hardening is stably retained. In this particular case, "direct" HTMT was carried out at 950°C with deformation by rolling leading to a 50% reduction of area. Immediately after deformation the steel was quenched in oil. Subsequently, the specimens were tempered at 200-600°C; prior to tempering some of the specimens were cold-rolled with a 5% reduction in area. Reheating of the specimens produced the "hereditary hardening effect," i.e. restoration of the high level of strength properties, except in the specimens subjected to the cold plastic deformation with 5% reduction in area, which shows that even a limited degree of cold working eliminates the "hereditary hardening effect" by disturbing the uniformly distributed and stabilized systems of dislocations. The character of change in properties corresponds to the change in fine structure. The physical widening of the diffraction lines of the atomic planes of α -solid solution is greater without than with such cold working, in such cases. Orig. art. has: 3 figures.

2/3

Card

L 1052-66

ACCESSION NR: AP5022355

ASSOCIATION: none

SUBMITTED: 00

ENCL: 00

SUB CODE: MM, 88

NO REF SOV: 003

OTHER: 000

Card 3/3

DP

BANNYKH, O.A.; ZUDIN, I.F.; KASHIN, V.I.; FLORESIEN, D.A.; SAMARIN A.M.

Properties of ferritic iron-aluminum alloys. Trudy Inst. met. no.14:
68-77 '63 (MIRA 17:8)

1. Chlen-korrespondent AN SSSR; otvetslvennyy redaktor zhurnala
"Trudy Instituta metallurgii" (for Samarin).

ACCESSION NR: AR4041546

S/0137/64/000/004/1055/1055

SOURCE: Ref. zh. Metallurgiya, Abs. 41337

AUTHOR: Bratenko, V. N.; Zudin, N. F.; Prokoshkin, D. A.

TITLE: Influence of alloying on hardening of chromium-manganese austenitic steels

CITED SOURCE: Sb. Issled. po vysokeprochn. splavam nitevidn. kristallam. M., AN SSSR, 1963, 178-183

TOPIC TAGS: alloying, hardening, chromium steel, manganese steel, austenitic steel

TRANSLATION: Investigates influence of alloying of Ti, V, Mo, and W on strength and plasticity of Fe-Cr-Mn steel (18% MN, 12% Cr and 0.2% N) in interval 20-700°.

With increase of content of V, increases at room temperature and plasticity worsens. Introduction of W and Mo little affects indication of the characteristic.

Card 1/2

L 10388-65

EWT(m)/EPF(n)-2/I/ENP(b) Pu-4 JD/JG/WB/MLK

ACCESSION NR: AT4045998

S/0000/64/000/000/0241/0247

AUTHOR: Prokoshkin, D. A.; Vasil'yeva, Ye. V.; Lazareva, I. Yu.

TITLE: Oxidation kinetics of tungsten-niobium alloys

SOURCE: AN SSSR. Institut metallurgii. Issledovaniya metallov v zhidkom i tverdom sostoyaniyakh (Research of metals in liquid and solid states). Moscow, Izd-vo Nauka, 1964, 241-247

TOPIC TAGS: tungsten niobium alloy, tungsten oxidation, tungsten niobium alloy oxidation, tungsten alloy oxidation kinetics

ABSTRACT: Experiments have been conducted to determine the kinetics of oxidation of binary tungsten-niobium alloys containing from 1 to 50% Nb. Alloys were melted from 99.95% pure tungsten and 99.78% pure

L 10388-65

ACCESSION NR: AT4045998

30% Nb follows the parabolic rate as in the case of unalloyed tungsten. The alloy with 30% Nb was found to be the most resistant to oxidation. Its weight gain in 4 hr amounted to 14.2 mg/cm² at 1000C, 19.4 mg/cm² at 1100C, 27.2 mg/cm² at 1200C, and 55 mg/cm² at 1300C. Alloys with 40 and 50% Nb are less oxidation resistant than alloys with 30% Nb, but more resistant than alloy with 10% Nb. The oxide layer of alloys with 1-20% Nb has a laminated structure; the oxide layer of alloys with 30, 40, and 50% Nb consists of fine lamellas. The alloy with 30% Nb has the thinnest oxide layer. The oxide layers on all alloys tested adhere more tightly to the metal than in the case of unalloyed tungsten; nevertheless, they can be removed easily. The tungsten content in the oxide layer gradually decreases and that of niobium increases in proportion to Nb alloying. The oxidation temperature has little effect on the content of W and Nb in the oxide

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ACCESSION NR: AT4045998

SUBMITTED: 18May64

ATD PRESS: 3116

ENCL: 00

SUB CODE: MM, GC

NO REF SOV: 009

OTHER: 004

Card 3/3

L 13978-65 EWT(m)/EPF(n)-2/T/EWP(t)/EPA(bb)-2/EWP(b) Pu-4 ASD(f)-2/ASD(m)-3
JD/JG/MLK

ACCESSION NR: AT4045999

S/0000/64/000/000/0248/0254

AUTHOR: Vasil'yeva, Ye. V.; Prokoshkin, D. A.

TITLE: Properties of ternary niobium-tantalum-molybdenum alloys

SOURCE: AN SSSR. Institut metallurgii. Issledovaniya metallov v zhidkom i tverdom sostoyaniyakh (Research of metals in liquid and solid states). Moscow, Izd-vo Nauka, 1964, 248-254

TOPIC TAGS: niobium, niobium alloy, alloy property, tantalum containing alloy, molybdenum containing alloy

ABSTRACT: Ten Nb-Mo-Ta alloys containing 10% Mo and 0.25-15 wt% Ta were investigated. The alloy specimens were melted in an arc furnace in argon and annealed at 2000C for 10 hr (also in an argon atmosphere). Microscopic examination showed that all the alloys had a one-phase structure of a solid solution. The specific gravity of the alloys varied, depending on the composition, from 8.748 to 9.400 g/cm³, increasing with tantalum content. The oxidation tests conducted at 1000, 1100, and 1200C for a total of 21 hr showed that the oxidation at the beginning followed a parabolic rate which later became linear.

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L 13978-65

ACCESSION NR: AT4045999

The addition of tantalum (up to 4%) to Nb-Mo alloy decreased somewhat the oxidation rate at all three temperatures tested. For instance, after 21 hr at 1000, 1100, and 1200C, an alloy with 0.5% Ta gained 151.3, 174.0, and 260.0 mg/cm², respectively; and an alloy with 4% Ta gained 119.7, 137.1, and 243.0 mg/cm², respectively. At 5% Ta the oxidation rate began to increase, remaining, however, below that of unalloyed niobium. X-ray diffraction patterns showed that the oxide layer on all the alloys tested was a solid solution of tantalum and molybdenum oxides in β -Nb₂O₅. The hardness of alloys at room and high temperatures and the creep strength at 1000C increased with increasing tantalum content. Orig. art. has: 5 figures and 3 tables.

ASSOCIATION: none

SUBMITTED: 18May64

ENCL: 00

SUB CODE: MM

NO REF SOV: 005

OTHER: 004

ATD PRESS: 3137

Card 2/2

BYSTROV, L.N.; IVANOV, L.I.; PROKOSHIN, D.A.

Investigating the diffusion of nickel in nickel-copper alloys. Issl.
po zharoproch. splav. 10:44-46 '63. (MIRA 17:2)

PROKOSHIN, D.A.; MATVEYEVA, M.P.; MOROZOV, V.A.

Investigating the process of the plastic deformation of chromium at high temperatures. Issl. po zharoproch. splav. 10:22-27 '63. (MIRA 17:2)

PROKOSHIN, D.A.; VASIL'YEVA, Ye.V.; RYABYSHEV, A.M.

Investigating the kinetics and the mechanism of the oxidation of
niobium-molybdenum alloys. Issl. po zharoproch. splav. 10:233-239
'63. (MIRA 17:2)

PROKOSHKIN, D.A.; VASIL'YEVA, Ye.V.; POPOV, N.N.

Properties of alloys of the system niobium - tungsten - titanium.
Issl. po zharoproch. splav. 10:219-225 '63. (MIRA 17:2)

PROKOSHKIN, D.A.; ARZAMASOV, B.N.; Prinimal uchastiye V.A. Prostrem

Investigating the system chromium - tungsten by the thermal diffusion
method. Issl. po zharoproch. splav. 10:225-228 '63. (MIRA 17:2)

PROKOSHKIN, D.A.; BANNYKH, O.A.; KOVERNITSYY, Yu.K.; ZUDIN, I.F.

Investigating the phase constitution of chromium-manganese-aluminum steel. Issl. po zharoproch. splav. 10:138-143 '63.

Chromium-manganese-aluminum austenitic steel. Ibid.:144-148
(MIRA 17:2)

PROKOSHKIN, D.A.; SIDUNOVA, O.I.

Investigating the system chromium - molybdenum by the thermal diffusion method. Issl. po zharoproch. splav. 10:229-232 '63. (MIRA 17:2)

Prokoshkin, D.A.

D. A. Prokoshkin and others. Magnetic, optical, and other properties of refractory elements and the oxidation resistance of beryllides of refractory elements.

Title: Seminar on refractory metals, compounds, and alloys (Kiev, April 1963).

Source: Atomnaya energiya, v. 15, no. 3, 1963, 266-267

ARZHANYI, P.M.; VOLKOVA, R.M.; PROKOSHIN, D.A.

Investigating the kinetics of oxidation and the structure of
certain high-melting metal oxides. Issl. po zharopr. splav. 94
172-183 '62. (MIRA 16:6)
(Oxidation) (Alloys--Thermal properties)

ARZHANYI, P.M.; VOLKOVA, R.M.; PROKOSHIN, D.A.

Study of the niobium - beryllium system. Dokl. AN SSSR 150
no.1:96-98 My '63. (MIRA 16:6)

1. Institut metallurgii im. A.A.Baykova. Predstavleno akademikom
A.A.Bochvarom.

(Niobium-beryllium alloys)

PROKOSHKIN, D.A.; VASIL'YEVA, Ye.V.

Oxidation of certain niobium-base binary alloys. Issl. po zharopr.
splat. 9:164-171 '62. (MIRA 16:6)
(Niobium alloys) (Oxidation)

PROKOSHKIN, D.A.; ARZAMASOV, B.N.

Circulating method of saturating molybdenum by certain elements.
Issl. po zharopr. splav. 9:177-183 '62. (MIRA 16:6)
(Molybdenum alloys) (Case hardening)

PROKOSHKIN, D. A.

High-strength steel. Trudy Inst. met. no. 13:108-121 '63.
(MIRA 16:4)

(Steel--Hardening)

ARZHANYI, P.M.; VOLKOVA, R.M.; PROKOSHIN, D.A.; Primalni uchastnye:
PETROVA, R.V., IL'YASHEVA, N.A.

Investigating the diffusion of silicon and titanium in niobium.
Trudy Inst. met. no.11:78-82 '62. (MIRA 16:5)
(Niobium—Metallography) (Diffusion coatings)

PROKOSHIN, D. A.; VASIL'YEVA, Ye. V.

Connection between hardness and mechanical properties of
metals and alloys. Trudy Inst. met. no.13:131-142 '63.
(MIRA 16:4)

(Metals—Testing) (Hardness)

PROKOSHIN, D. A.; VASIL'YEVA, Ye. V.; Prinizhala uchastiye AGIBALOVA, L. M.

Kinetics and the mechanism of niobium oxidation. Trudy Inst.
met. no. 13:143-151 '63. (MIRA 16:4)

(Niobium—Metallography)
(Oxidation)

BYSTROV, L.N. (Moskva); IVANOV, L.I. (Moskova); PROKOSHKIN, D.A. (Moskva);
Prinimal uchastiye KARPOV, F.F., student

Creep of copper and copper-nickel alloys under torsion. Izv. AN SSSR.
Otd. tekhn. nauk. Mat. i topl. no. 5:197-209 S-O '62. (MIRA 15:10)

1. Moskovskiy gosudarstvennyy pedagogicheskiy institut imeni Lenina
(for Kaprov).
(Creep of copper) (Torsion)

PROKOSHKIN, D.A. (Moskva); VASIL'YEVA, Ye.V. (Moskva)

Process and products of the oxidation of niobium-titanium alloys.

Izv. AN SSSR. Otd. tekhn. nauk. Met. i topl. no. 5:151-156 S-0'62.

(MIRA 15:10)

(Niobium-titanium alloys--Metallography)
(Oxidation)

PROKOSHKIN, D. A. (Moskva); MATVEYEVA, M. P. (Moskva); PLATOV, Yu. M.
(Moskva)

Observing dislocations in cast and deformed polycrystalline
chromium. Izv. AN SSSR. Otd. tekhn. nauk. Met. i topl. no.6:
107-111 N-D '62. (MIRA 16:1)

(Chromium—Metallography)
(Dislocations in metals)

S/137/62/000/012/020/085
A006/A101

AUTHORS: Sharipkulov, R. S., Prokoshkin, D. A.

TITLE: On the stability of chrome-manganous steel austenite during cold deformation

PERIODICAL: Referativnyy zhurnal, Metallurgiya, no. 12, 1962, 27, abstract 121174 (In collection: "Vopr. energ. gidrotekhn. i gorn. dela", Tashkent, AN UzSSR, 1961, 231 - 237)

TEXT: The authors studied the effect of alloying elements upon the quantity of the ferromanganese phase and the stability of the austenite after tensile deformation in two series of stainless Cr-Mn steels specified as X 18Г15 (Kh18G15) (6 heats) and X17Г12 (Kh17G12) (8 heats). KhVГ15 steel contains in %: C 0.05 - 0.07, Cr 17.66 - 18.90, Mn 14.52 - 15.52, Ni 0.89 - 3.65, N 0.13 - 0.31, Si 0.25 - 0.39, S 0.007 - 0.01, P 0.015 - 0.18. Kh17G12 steel contains in %: C 0.04 - 0.08, Cr 17.03 - 17.59, Mn 10.73 - 12.22, N 0.10 - 0.22, Cu 0.35 - 0.97, Si 0.19 - 0.44, S 0.006 - 0.01, P 0.003 - 0.014. All the specimens were heated to 1,000°C during 1 hour and water-cooled. The effect of N, Cu and Ni

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On the stability of chrome-manganous steel...

S/137/62/000/012/020/025
A006/A101

upon the amount of the magnetic phase was studied by microstructural and magnetic methods. The magnetic phase was determined on specimens 3 mm in diameter and 5 mm length, cut out of elongated specimens. It was established that N was the strongest austenite-forming element. In alloying Cr-Mn steel with 17 - 20% Cr, 12 - 15% Mn and 0.2 - 0.4% N it is possible to obtain a single-phase austenite structure. Alloying with Cr-Mn-steel with 0.97% Cu increases slightly the austenite content in the steel. N is a strong stabilizer of austenite. In steel with $\sim 0.3\%$ N austenite transformation does not take place even at high deformation degrees ($\delta > 50\%$). Steel alloyed with Cu, remains stable during cold treatment whereas in Kh17G12 steel alloyed with Cu, partial transformation takes place after preliminary plastic deformation. There are 10 references.

I. Strebkov

[Abstracter's note: Complete translation]

Card 2/2

S/180/62/000/005/011/011
E193/E383

AUTHORS: Bystrov, L.N., Ivanov, L.I. and Prokoshkin, D.A.
(Moscow)

TITLE: Creep of copper and copper-nickel alloys in torsion

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Otdeleniye
tekhnicheskikh nauk. Metallurgiya i toplivo,
no. 5, 1962, 197 - 209

TEXT: The paper reports the results of an investigation on
creep of copper and copper-nickel alloys with 0.5, 1.0, 10, 20
and 30% Ni. Cylindrical test pieces were machined from vacuum-
melted, forged and then cold-rolled materials. Torsion creep
tests were conducted at 450 - 1 100 °C under stresses ranging
from 3.94×10^7 to 27.2×10^7 dynes/cm². Each test piece was
given a 20-min anneal at 1 050 °C before the tests. The results
obtained for copper are reproduced in fig. 1, where

$\log(\dot{\epsilon}T\mu^{3.5})$ is plotted against $1/T \cdot 10^4$, curves 1-6 relating to
tests conducted under stresses of 1 - 40 kg/cm², 2 - 65, 3 - 89,
4 - 133, 5 - 205, 6 - 276 ($\dot{\epsilon}$ is the creep rate, deg/sec,
Card 1/3

Creep of copper

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E193/E383

μ is the elastic modulus, dynes/cm² and T is temperature, °K). It will be seen that at rates of creep exceeding a certain critical value, $\dot{\epsilon} \sim 10^{-5}$ deg/sec, the experimental points form straight lines, the slope of which is practically independent of the applied stress, giving the activation energy for creep of copper equal to 46.9 ± 3.3 kcal/mole, which is very near to the value of the activation energy for self-diffusion of copper. The stress dependence of the rate of creep was found to be $\dot{\epsilon} \sim \epsilon^{-6.52}$. Below the critical value of $\dot{\epsilon}$ the experimental points in Fig. 1 deviated from the linear relationship to an extent which increased with decreasing stress. Creep curves [deformation (ϵ , deg) versus time (t , min)] for copper specimens tested under a stress of 40 kg/cm² at 940 °C (graph a) and 870 °C (graph b) are reproduced in Fig. 3. It will be seen that, in this case, the rate of creep under conditions of constant temperature and stress does not remain constant but periodically increases in a step-like fashion. Metallographic examination of copper specimens at various stages of creep under various conditions showed that this effect was not associated with

Card 2/5.3

Creep of copper

S/180/62/000/005/011/011
E193/E383

grain-boundary slide. The departure of the $\log(\dot{\epsilon}T\mu^{3.5})$ versus $1/T \times 10^4$ relationship from linear was also observed in the case of copper-nickel alloys containing less than 10% nickel; the effect was confined to test pieces tested under low stresses. A large part of the present paper is concerned with the physical meaning of the step-like change in the rate of creep mentioned above, which is associated with the departure of the $\log(\dot{\epsilon}T\mu^{3.5})$ versus $1/T \times 10^4$ relationship from linearity. The following explanation was postulated: the field of stress of dislocations piled up against the grain boundaries will increase with increasing deformation in proportion to the number of these dislocations. The field acts, on the one hand, on the Frank-Reed sources, reducing the number of dislocation loops generated and, on the other hand, exerts ever increasing pressure on the boundary dislocation walls. When this pressure exceeds a certain critical value, a void can be formed at the grain boundary, into which the dislocation pile-ups can be discharged. As a result, the field of stress suppressing the activity of the Frank-Reed sources disappears and the rate of creep sharply increases.

Card 3/53

S/659/62/008/000/009/028
I048/I248

AUTHORS: Prokoshkin, D.a., and Zakharova, M.I.

TITLE: The isothermal section at 1200°C of the phase diagram
for the system niobium-molybdenum-chromium

SOURCE: Akademiya nauk SSSR. Institut metallurgii, Issledovaniya po zharoprochnym splavam. v.8. 1962. 70-74

TEXT: Alloys of the niobium-molybdenum-chromium system were tempered at 1200° and subjected to a series of microstructure, x-ray, and hardness studies; the results are summarized in the form of the isothermal section at 1200°, and of graphs showing the variations in the lattice parameters of the various phases as a function of the Cr content. The solubility of chromium in niobium at 1200° is 11% (all percentages given are atomic), that of Nb in

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S/659/62/008/000/009/028
I048/I248

The isothermal section....

Cr is 2%. In the binary Mo-Cr system, all alloys containing 10-15% Mo consist of a single phase with a b.c.c. lattice. In the ternary system Nb-Mo-Cr, all alloys containing above 50% Mo are composed of a single phase with a b.c.c. lattice, designated as the $\alpha(\beta)$ phase. Another single phase with a narrow range of homogeneity is confined within the points 62-68% Cr on the 0% Mo line and 11% Mo on the 61% Cr line; the structure of the phase corresponds to that of the intermetallic compound NbCr_2 , and it is designated as the δ phase. The α and β phases exist in the Nb-rich and the Cr-rich corners of the isothermal section, respectively. There are three two-phase and one three-phase regions: $\alpha + \beta$, $\alpha + \delta$, $\beta + \delta$, and $\alpha + \beta + \delta$. There are 4 figures.

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S/659/62/009/000/024/030
1003/I203

AUTHORS Prokoshkin, D. A., and Vasil'yeva, E. V.

TITLE: On the oxidation of some binary niobium-base alloys

SOURCE: Akademiya nauk SSSR. Institut metallurgii. Issledovaniya po zharoprochnym splavam v. 9. 1962. Materialy Nauchnoy sessii po zharoprochnym splavam (1961 g.), 164-171

TEXT: There is little data in the literature on the structure and on the properties of the scale formed on niobium-base alloys. The influence of Ti, V, Cr, Si, Ta, Mo, W, Al, and B on the resistance of Nb alloys to scale formation was investigated by determining the weight increase in samples after they had been heated in the air for 1, 2, 3, 5, and 10 hours at 1000°, 1100°, 1200° and 1300°C. An X-ray analysis of the scale was then conducted. The results show that the alloying of niobium leads to a change in the diffusion of oxygen through the scale formed, to the formation of new phases in the scale, and to changes in the plastic properties of the scale. Alloying also changes the crystal parameters of the scale and of the adjacent layers. In the discussion, A. I. Dedyurin reported on his investigations on ternary and on more complex niobium-base alloys. There are 2 tables and 1 figure.



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S/659/62/009/000/025/030

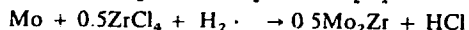
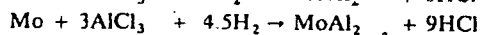
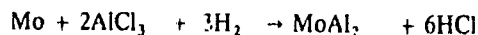
1003/1203

AUTHORS Prokoshkin, D. A., and Arzamasov, B. N.

TITLE A circulation method of impregnation molybdenum with some elements

SOURCE Akademiya nauk SSSR. Institut metallurgii. Issledovaniya po zharoprochnym splavam v 9 1962. Materialy Nauchnoy sessii po zharoprochnym splavam (1961 g.), 177-183

TEXT. Molybdenum alloys may only be used as heat-resisting materials after their surface has been given a proper protection against oxidation. In this work the results are given of heating molybdenum alloys with chlorides of silicon, aluminum, zirconium or chromium in gaseous mixtures of hydrogen. The reaction which take place on the surface of molybdenum during these processes are.



A similar process carried out with chromium did not succeed. In this circulation process the hydrogen chloride generated in the above chemical processes is continuously reused as it serves as a carrier of the diffusing elements to the surface of the treated metal. A description of two schemes of apparatus for the conduction of this process is given, as well as photomicrographs of the surface layers of molybdenum treated as above. There are 7 figures and 1 table.

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IVANOV, L.I. (Moskva); MATVEYEVA, M.P. (Moskva); MOROZOV, V.A. (Moskva);
PROKOSHKIN, D.A. (Moskva)

Self-diffusion in chromium. Izv. AN SSSR. Otd. tekhn. nauk. Met.
1 topl. no.2:104-106 Mr-Apr '62. (MIRA 15:4)
(Chromium--Metallography) (Diffusion)

S/123/62/000/015/005/013
A052/A101

AUTHORS: Arzhanyy, P. M., Volkova, R. M., Prokoshkin, D. A.

TITLE: Oxidation kinetics of niobium and its compounds

PERIODICAL: Referativnyy zhurnal, Mashinostroyeniye, no. 15, 1962, 17, abstract 15B105 (In collection: "Issled. po zharoprochn. splavam". V. 7, Moscow, AN SSSR, 1961, 214 - 220)

TEXT: Niobium samples of the following chemical composition were investigated: 98.9% Nb, 0.4% Ta, 0.15% Pb, 0.13% Fe, 0.08% N, 0.09% O, 0.01% Si and 0.14% C. The diffusion layer was analyzed by metallographic, X-ray and X-ray spectral method and moreover, microhardness was measured. In the process of saturating niobium with Ti and Si, a diffusion layer of a complex structure and composition is formed. At 900 - 1,100°C a layer with a microhardness of about 1,200 kg/mm² is formed, and at 1,200 - 1,300°C 2 layers are formed, the thickness of the second layer being 5 - 6 microns. The thickness of diffusion layers depends on the temperature and time of saturation. At a constant saturation temperature of 1,100°C this dependence can be expressed by the formula $X^{2.2} = 17\tau$, where x is

Card 1/2

Oxidation kinetics of niobium and its compounds

S/123/62/000/015/005/013
A052/A101

the depth of the layer in microns and τ is the time in hours. As a result of the investigation, the oxidation kinetics of the initial Nb and Nb saturated with Ti and Si was established. The kinetics and phase composition of the diffusion layer and oxide film were studied and the activation energy of oxidation was calculated. It has been established that the surface of Nb protected by Si and Ti oxidizes at 1,200°C almost 1.5 times slower than the surface protected by Si only. There are 1 diagram and 5 tables.

T. Kislyakova

[Abstracter's note: Complete translation]

Card 2/2

S/137/62/000/006/133/163
A052/A101

AUTHORS: Arzhanyy, P. M., Volkova, R. M., Prokoshkin, D. A.

TITLE: Oxidation kinetics of niobium and its compounds

PERIODICAL: Referativnyy zhurnal, Metallurgiya, no. 6, 1962, 84, abstract 6I529
(V sb. "Issled. po zharoprochn.splavam". T. 7, Moscow, AN SSSR, 1961, 214 - 220)

TEXT: The oxidation of Nb after its surface alloying with various elements was studied. The investigation was carried out on Nb of the following composition (in %): 98.9 Nb, 0.4 Ta, 0.15 Pb, 0.13 Fe, 0.08 N, 0.09 O, 0.01 Si, 0.14 C, $5 \cdot 10^{-5}$ B. The hardness of the initial material was 200 kg/mm². Nb samples were saturated with Si and Ti. The diffusion layer was analyzed by metallographic, radiographic and radiospectral methods and also by measuring microhardness. In the process of saturating niobium with Ti and Si, a diffusion layer of a complex structure and composition is formed. At 900 - 1,100°C one diffusion layer of ~1,200 kg/mm² microhardness is formed and at 1,200 and 1,300°C two diffusion layers. The layer formed on the surface is Nb disilicide with Ti dissolved in it.

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Oxidation kinetics of niobium and its compounds

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A052/A101

The activation energy of oxidation of Si-saturated Nb is equal to 8,540 cal/mole and the activation energy of oxidation of Si and Ti saturated Nb to 3,660 cal/mole. The surface of Nb protected with Si and Ti oxidizes at 1,200°C nearly 1.5 times more slowly than the surface of Nb protected with Si only. The oxidation kinetics of Nb was studied depending on the character of the oxide formed. There are 6 references.

Ye. Layner

[Abstracter's note: Complete translation]

Card 2/2

I. 23573-65 EWT(m)/EPF(n)-2/EWA(d)/EWP(t)/EWP(b) Pu-4 IJF(c) MJW/JD/
JG/WB
ACCESSION NR AM1045086 BOOK EXPLOITATION S/

Prokoshkin, Dmitryly Antonovich; Vasil'yeva, Yelena Valentinovna

Niobium alloys (Splavy* niobiya), Moscow, Izd-vo "Nauka", 1964, 330 p. illus.,
biblio. Errata slip inserted. 2,000 copies printed. (At head of title:
Akademiya nauk SSSR. Gosudarstvennyy komitet po chernoy i tsvetnoy metallurgii
pri Gosplane SSSR. Institut metallurgii im. A. A. Baykova)

TOPIC TAGS: niobium alloy

PURPOSE AND COVERAGE: This book examines the basic principles of the metallurgy
of niobium and its alloys. It reviews the physical, chemical, mechanical, thermal,
nuclear, and engineering properties of niobium and the possibilities for its appli-
cation. In the light of modern physical-chemical concepts, the phase diagrams of
binary, ternary, and more complex systems of niobium based alloys are described.
Information on the composition, structure, physical, mechanical, and engineering
properties of alloys and their use is presented. Each chapter unifies the informa-
tion on alloys of niobium with a group of elements with similar physical-chemical
properties. The characteristics of high-temperature oxidation are considered and
the problems of heat-resistant alloys are discussed. The mechanical properties of
alloys at high temperatures are described. Considerable attention is given to the
mechanisms of deformation, creep, failure, and high-temperature oxidation.
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L 23573-65

ACCESSION NR AM4045086

book is of interest to scientific workers, engineers, and technicians concerned with problems of metallurgy and the physics of refractory, rare, and nonferrous metals and also to teachers, graduate students, and students of higher educational institutions.

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SUB CODE: MM

SUBMITTED: 05Feb64

NR REF SCV: 171

OTHER: 436

Cord 2/2

L 16586-65 EWT(m)/EWP(w)/EWA(d)/EWP(t)/EWP(b) ASD(m)-3 MJW/JD/MLK
ACCESSION NR: AT4045995 S/0000/64/000/000/0199/0201

AUTHOR: Prokoshkin, D. A.; Gavze, M. N.; Baranov, G. N. B+1

TITLE: Effect of alloying additions on certain mechanical properties
of austentic chromium-nickel-manganese steel of the 14-6-9 type at
room and subzero temperatures 18

SOURCE: AN SSSR. Institut metallurgii. Issledovaniya metallov v
zhidkom i tverdom sostoyaniyakh (Research of metals in liquid and
solid states). Moscow, Izd-vo Nauka, 1964, 199-201

TOPIC TAGS: chromium nickel manganese steel, EI100 steel, EI100 steel
property, EI100 steel additional alloying 18

ABSTRACT: The effect of additional alloying of the chromium-nickel-
manganese austentic steel of the 14-6-9 type (EI-100) has been stu-
died in an attempt to increase the yield strength without affecting
the austentic structure, and consequently the ductility, at tempera-
tures from 500C to -196C. The alloying additions included 0.16-6.22%
N, 0.03-0.16%C, 1.96 and 2.0% Cu, 2% Co, 1.66% V, 1.80 and 2.03% W, or

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L 16586-65

ACCESSION NR: AP4045995

1.78% Mo. Steels were melted in an induction furnace, forged, annealed at 1150C, water quenched, and tested at room temperature and at -196C, it was found that additional alloying with elements forming substitutional solid solutions has no affect on yield strength. Alloying with elements forming interstitial solid solutions, and as carbon and nitrogen, produces better results. The increase of carbon content, especially when combined with addion of nitrogen raises the yield strength of of steel. However, while C and N have no adverse effect on steel ductility at room temperature, they lower the notch toughness considerably at -196C when the content of carbon is increased to 0.07%. Although the notch toughness remains at a satisfactory level, it may drop below this level as a result of the precipitation of carbides occuring at the upper level of operational temperatures, 500C. It follows therefore that the steel under investigation, cannot serve as a lease for high-strength steels suitable for operation in the temperature range from 500C to -196C. / Orig. art. has: 3 tables

ASSOCIATION: none

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L 16586-65
ACCESSION NR: AP4045995

SUBMITTED: 18May64

ENCL: 00

SUB CODE: MM

NO REF SOV: 001

OTHER: 002

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L 15197-65 EWT(m)/EWP(w)/EWA(d)/EWP(t)/EWP(b) ASD(m)-3 JD/MLK
ACCESSION NR: AT4046847 S/0000/64/000/000/0230/0235

AUTHOR: Prokoshkin, D. A.; Kovneristy*y, Yu. K.; Bapny*kh, O. A.; Zudin, I. F.
(Candidate of technical sciences) B

TITLE: Effect of carbon on the mechanical properties of austenitic chromium manganese steel, carbon steel, steel mechanical property, steel creep, 46

SOURCE: AN SSSR. Nauchny*y sovet po probleme zharoprochny*kh splavov. Issledovaniya staley i splavov (Studies on steels and alloys). Moscow, Izd-vo Nauka, 1964, 230-235

TOPIC TAGS: alloy steel, austenitic steel, chromium manganese steel, carbon steel, steel mechanical property, steel creep

ABSTRACT: Impact toughness (after quenching annealed samples in water from 1050C, or after aging them at 700C for 5, 100, and 500 hrs), tensile strength at 20 and 700C, and creep at 650C and 9 kg/mm² were investigated in 26 melts of chromium (8-12%) and

manganese (10-20%) based steels with additions of molybdenum, tungsten, niobium and boron additions in a study of the effects of varying carbon content (0.07-0.92%) on the mechanical properties of these types of austenitic steel. The 4-kg ingots, obtained in magnesite crucibles in an induction furnace, were forged at 750-1100C to circular blanks 12 or 18 mm in diameter. The chromium-manganese steel, hardened from temperatures which ensure formation of a monophasic B-solid solution,

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was found to possess a high impact toughness (16-22 kg/cm²). The higher the carbon content in the steel, the lower the impact toughness of steels aged at 700C for prolonged periods of time. Carbon strengthens the steel at 20 and 700C while aluminum stabilizes

creases the creep resistance of the steel at 650°C, but has no effect at 500°C.
point. Orig. art. has: 3 tables and 3 figures.

ASSOCIATION: none

SUBMITTED: 16Jun64

NO REF SOV: 006

ENCL: 00

SUB CODE: MM

OTHER: 000

Card 2/2